MEMORANDUM

To:	EPA
Copy To:	File 80021
From:	J. Lambert, J. Brunelle
Subject:	Olin: Revised Remedial Investigation Report, Operable Unit 3 Review Comments
Date:	7/31/19

Nobis Group® (Nobis) on behalf of the U.S. Environmental Protection Agency (EPA), has reviewed and generated the following comments on the "*Revised Remedial Investigation Report, Operable Unit 3*" (OU3 RI) prepared by Wood Environment & Infrastructure (Wood) on behalf of the Olin Corporation (Olin) for the Olin Chemical Superfund Site (Site) in Wilmington, Massachusetts (Wood, 2019).

Comments included below provide review of this OU3 RI. Nobis' comments (Nobis, 2019a) on the previous version of the OU3 RI (Wood, 2018) that have not been addressed have been retained. This memorandum also notes previous EPA comments (EPA, 2019) that have not been fully addressed.

1.0 MAJOR COMMENTS:

Major comments are provided by subject in the following subsections, starting with general comments on the document.

1.1 Overall Document

1. The document provides footnotes that summarize EPA's position where it differs from Olin's and describes additional work to address data gaps. The revised document will need to incorporate the results of that work, which include the recent comprehensive groundwater sampling and other investigations that are still in the planning stages.

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1.2 Geology/Hydrogeology

2. Please include a well construction table in the RI report that includes all monitoring wells and multi-level ports in the RI. This information is critical to evaluate subsurface data without resorting to locating individual boring and/or well construction logs.
3. Section 3.2.3.1: Please add an evaluation of the competence of the general bedrock surface and in areas where dense aqueous-phase liquid (DAPL) has been identified. Boring logs and other indirect measurements of surface competence is needed for evaluation, since borehole geophysics frequently begins below casing that has been grouted into rock.
4. Section 3.2.3.3; bedrock fracture orientation and frequency:
   a) Please add a discussion of borehole geophysics logs for OC-BB-1-2018, OC-BB-2-2018, GW-415, GW-416, and GW-80BR.
   b) With the addition of new bedrock wells (including the ones indicated in the previous comment), Olin should provide a more systematic evaluation of the bedrock data, rather than describing each borehole and including a general summary at the end. This section should include a summary table describing significant fracture orientation, aperture, and frequency (normalized to a per-foot basis) to compare bedrock boreholes and sections (if applicable) in different geologic and hydrostratigraphic units.
   c) The previous draft of the report included a figure depicting borehole geophysics results on a site plan. A revised version of this figure should be included in future versions of this report. If the figure layout does not allow for enough space to include both rose diagrams and upper hemisphere plots (especially if additional bedrock boreholes are added), Olin should depict only the rose diagrams, since they are easier to discern.
5. Olin should expand the discussion of bedrock hydrogeology (Section 3.4) to include the following topics:
   a) Evaluation of the potential for fracture interconnection and groundwater transport: While bedrock groundwater flow is through individual fractures, several bedrock

boreholes have extremely large fractures and fractured zones. Olin should identify if these significantly fractured zones are analogous to a porous medium.

b) Presence and thickness of a weathered bedrock zone at the top of bedrock.

c) Evaluation of the potential for groundwater flow in bedrock near the bedrock DAPL pools and other DAPL areas.

6. Please discuss the expected fracture regime near Cook Avenue and describe the quantity and quality of hydrogeologic data available to determine the potential bedrock migration pathways in this area.
7. Section 3.6 has been updated with a discussion of the maps in Smith, 1997 and suggests that the most significant pumping was by the Sanmina (Altron) wells. However, we do not agree with figure notes on Page 840 and page 841 in Appendix PDF) because:
   a) The lowest groundwater elevation near the Altron property is at GW-44S/D, located slightly to the north. Olin's suggested concentration contours for Plate 2-4 appear to ignore the density-adjusted water levels south of GW-43D.
   b) The water levels shown on the figures are within the same range as the post-pumping water levels. Given that water levels at the off-property west ditch were lower than the water levels closest to the pumping wells (GW-44S/D and GW-43S/D), we do not see physical evidence for a significant cone of depression. In contrast, the water levels close to the Town wells, such as those at GW-65D were 69.05 feet MSL in 1995 compared to 80.02 feet in May 2011.
   c) The chemical data presented in Appendix J does provide evidence of chemical fluctuations potentially related to West Ditch impacts, but not to the extent of showing a clear difference in water levels from the Altron wells.
8. The current text does not discuss the pumping of the Town wells. The impact of the pumping of the Town wells should be discussed separately in a discussion of the Maple Meadow Brook Wetland (MMBW).

1.3 Contamination

9. DAPL definition: Section 1.3.7 (page 1-13 and last paragraph of page 1-14) describes the unvalidated data from the 2019 comprehensive groundwater sampling round and indicates that they are consistent with previous results. Olin should redevelop the definition of the DAPL and concentration profiles through the DAPL should be produced once all validated results are in.
10. Section 4.4.5.3: Hexavalent chromium has been detected in some locations where total chromium has not. Extremely low hexavalent chromium concentrations may not be

anomalous since total chromium detection limits were higher than those for hexavalent chromium. Results of the 2019 comprehensive sampling event may eliminate this concern.

1.4 Conceptual Site Model/Fate and Transport

11. Section 1.3.6 - Role of the East Ditch in intercepting groundwater: we agree that the East Ditch appears to be intercepting shallow overburden groundwater; however, there are no bedrock wells east of the northern end of the property (where bedrock is shallow). The extent that the East Ditch is capturing deeper groundwater is a current data gap.
12. Section 5.1.2 - Source of groundwater impacts to South Ditch: Olin has provided additional support for their theory that South Ditch contamination is from impacted groundwater at the Jewel Drive (OPWD) DAPL pool (specifically, that past concentration increases are from backflow of groundwater across the OPWD DAPL pool after pumping ended at Sanmina/Altron). We agree that some groundwater contamination may be from this source. However, the continued high concentrations of DAPL constituents at GW-202D (compared to GW-202S, the rest of the South Ditch area, and GW-24 and GW-25 immediately downgradient of the OPWD DAPL pool) suggest that an alternate source (deeper pocket of contaminated material, leakage beneath the slurry wall, or leakage in bedrock) may be impacting the South Ditch. Data from the recent comprehensive sampling event that includes more wells between the OPWD DAPL pool and the South Ditch (such as GW-408S/D) will provide more clarity regarding this issue.
13. Section 5.1.2 – Hydraulic connectivity: Olin has provided a more detailed discussion of the potential connection between overburden and bedrock near the Chestnut Street town wells. Olin's hypothesis that bedrock may be acting more as a porous medium and that the overburden and bedrock are hydraulically connected is reasonable based on the evidence provided. If bedrock is sufficiently fractured, it may be considered an equivalent porous medium, particularly in this area of the MMBW.
14. Section 5.1.3 - Aberjona watershed: Olin should include the following additional routes of migration:
    a) Migration of dissolved constituents from the area south of the containment area in deep overburden and bedrock off-site to the southeast.
    b) Migration of dissolved constituents in bedrock from the DAPL pools to the south, where they may be intercepted by private drinking water wells.

2.0 MINOR COMMENTS:

Minor comments are listed by report section below.

2.1 Section 1: Introduction and Background

1. Section 1.3.6: Please show the former Middlesex Canal on Figure 1.3-1 as indicated in the text.
2. Section 1.4.1: Please include a reference to Table 1.2-1 (Processes and Products).
3. Section 1.4.2.3, 3rd paragraph (page 1-16): Lake Poly has been identified as a primary source area for OU3. The text notes that Lake Poly has been the subject of several investigations, as documented in the FRI (MACTEC, 2007) and in several Massachusetts Department of Environmental Protection (MassDEP) submittals. Please provide references to the primary MassDEP submittals where this information can be found.

2.2 Section 2: Study Area Investigations

4. The last paragraph of the Section 2 introduction refers to the FRI (MACTEC, 2007) for a list of previous investigations conducted through 2006, supplemented by the RI Work Plan (MACTEC, 2009) and OU3 Data Gap Work Plan (AMEC Foster Wheeler, 2015a). Given the large number of investigations conducted at the Site, it is not reasonable to require the reader to back-track through these documents for a list of previous investigations. Please include a table of investigations relevant to OU3, investigation dates, and references to reports, if available.
5. Section 2.1.2: Please add a reference for the results (or the most recent report for on-going monitoring) for each of the groundwater monitoring and investigation programs listed and add that reference to Section 8 (if not already included). References to be added include:
    a. Section 2.1.2.1: Sentinel well monitoring program: final report prior to program suspension.
    b. Section 2.1.2.2: n-nitrosodimethylamine (NDMA) IRA final completion report.
    c. Section 2.1.2.3: Report(s) documenting the 2003 groundwater sampling results and conclusions regarding Lake Poly groundwater.
    d. Section 2.1.2.5, 2.1.2.6: most recent Semi-Annual Summary Report (SASR).
    e. Section 2.1.2.6: documentation of analytical/field results supporting addition of nutrient injection and increased air sparging for the treatment system at Plant B.
    f. Section 2.1.2.7: Most recent post-closure monitoring report for the Calcium Sulfate Landfill (CSL).

g. Section 2.1.2.9: March 2011 Seismic Data Report letter.

6. Section 2.1.2.3, 3rd paragraph: The section concludes that neither DAPL nor potential NDMA precursors were present at the former Lake Poly and that this feature is no longer an ongoing source of DAPL. Please add "in overburden groundwater" to these conclusions.
7. Section 2.1.2.8, 3rd paragraph: The last sentence indicates that locations close to the crest of the bedrock saddle have "diluted" concentrations of DAPL constituents, while samples from outside the reservoir have "ambient" groundwater conditions. Please indicate if the "diluted" concentrations the same as "diffuse" groundwater, and what range of concentrations were detected in the "ambient" groundwater. Please be consistent with terminology.
8. Section 2.1.2.9, 3rd and 4th paragraph: Please revise the discussion of seismic studies to clarify how many studies were conducted and when. The first sentence of paragraph 3 should be "From 1997 to 2005", not "Since 1997".
9. Section 2.2.1, 10th and 11th bullet (page 2-20): please include other wells installed during the RI on Figure 2.2-1 or a separate figure, specifically:
    a. DAPL multi-port monitoring wells MP-1, MP-2 and induction logging wells ML-1 and ML-2.
    b. HPIT monitoring wells GW-409, GW-410, GW-411, and GW-412.
10. Section 2.2.1, 5th and 6th paragraphs (page 2-21): Olin should add a reference to the appropriate part of Section 3.
11. Section 2.2.4, page 2-25, last paragraph: The text states that DAPL extraction was re-started in July 2017. Please describe the current status of the DAPL extraction (pumping or not), total volume extracted, and current pumping rate if the system is still in operation. Please also provide a date for this update (month/year).
12. Section 2.2.8, last paragraph: Please provide a reference to the most recent SASR and include in the reference section.
13. Section 2.2.9: Please provide a figure that shows the sample locations used for the vapor intrusion assessment and list the samples/wells used in this assessment in a table. These locations do not appear in Appendix K (BHHRA).

2.3 Section 3: Physical Characteristics and Land Use

14. Section 3.1, last paragraph (page 3-2) states that the wetland boundary was delineated as described in the RI/FS work plan (MACTEC, 2009); however, the only description of the wetland in this document is Table 3.2-1, which describes the BSC revision of the delineation (September 2004) but does not provide any further description. Please provide

a description of the wetlands based on a primary source (assumed to be the BSC revised delineation) and assess the appropriateness of this delineation, given that it is more than 13 years old. Please describe if any development, significant flooding, or other potential impacts have changed the wetland.

15. Section 3.1.1: Please add a description of the floodplains and potential flooding impacts at the Site. We recommend creating a separate subsection for this discussion. Please also add a figure depicting the floodplains, including the 10-year, 100-year, and 500-year, if applicable. Note that the Smith report refers to a 1993 Conestoga-Rovers & Associates (CRA) report for a discussion of the floodplains, so this description is more than 25 years old. Please use an updated reference.
16. Section 3.2.3.3: Please organize the discussion of individual bedrock boreholes in alphanumeric order.
17. Section 3.2.3.3, 1st paragraph: please clarify "large vertical bedrock boreholes" in the text. Does this mean that a cutoff of open borehole length was used for discussion, and if so, what was that cutoff? All boreholes with a reasonable amount of open borehole (at least 15 feet) should be included in this discussion.
18. EPA specific comment 52 (EPA, 2019, Appendix 1) requested water level hydrographs for all locations. This was not provided, although tabulated water levels were included.
19. Section 3.3, 2nd paragraph: In future document revisions, please replace the 2011 water level contours with the 2018 water level contours (if these are the most complete water levels) as primary figures, as the later water level rounds include additional data north of Eames Street and are more contemporaneous with the 2019 comprehensive groundwater data. Any groundwater contours not included in the "Figures" section should be included in the appendix, as was done for this report.
20. Section 3.3 would benefit from being separated into subsections, such as groundwater contours and flow directions; vertical gradients; horizontal gradients (including within the containment cell); hydraulic conductivity and aquifer materials; groundwater flow rates; and groundwater/surface water interactions.
21. Section 3.3: Please add discussion of groundwater/surface water interactions at the other surface water bodies, including: the east ditch, the off-property west ditch, and the MMBW. These should be included in upcoming synoptic water level rounds.
22. Section 3.8 (2nd and 3rd paragraphs): Please update these paragraphs with revised long-term temperature ranges since the meteorological references (CRA, 1993) are now 25 years old.
23. Section 3.9.2: Please add a figure showing current land use and zoning for the study area using data from MassGIS (OLIVER).

2.4 Section 4: Nature and Extent of Contamination

25. Section 4.1 has been revised to include a description of the Groundwater Use and Value Determination. The text removed discussion of non-potential drinking water source areas. This updated language appears acceptable but should be reviewed by MassDEP.
26. Section 4.2.4: Olin has presented a reduced DAPL pool volume compared to the previous RI:
    a) Jewel Drive decreased from 1.5 to 1.0 M gallons.
    b) Main Street decreased from 13.5 to 13.0 M gallons.
27. Section 4.3.1, 1st paragraph states that Table 4.3-1 compares analytical results to the Maximum Contaminant Level (MCL) or Regional Screening Level (RSL). Table 4.3-1 appears to show only MCL results. Please adjust either the table or the text appropriately.
28. Section 4.3.2, 2nd paragraph and Section 4.4.3.1 state that CVOCs have historically been ascribed to the former Altron/Sanmina property and an unnamed property east of the Olin property. Please provide references to documents supporting this statement.
29. Section 4.4.2.2, Chloride: The highest chloride concentrations are in deeper groundwater (deep overburden and bedrock). Olin states that road salt contributes to chloride in deep groundwater. While road salt contributes to chloride concentrations in shallow overburden, this is less likely for bedrock wells.
30. Section 4.4.2.5, Sodium: The text states that sodium concentrations up to 60 mg/L are considered anthropogenic (assumes the text means background from road salt application). Please provide additional description of how this number was derived. If an outside source was used, please provide a reference.
31. Section 4.4.3.3, VPH C5 to C8 Aliphatics: The text does not describe deep overburden concentrations and a figure is not shown for deep overburden. The text should state if VPH was not detected in deep overburden. If VPH was detected, it should be described, and a figure provided.
32. Section 4.4.4.3, Dibenzo(a,h)anthracene: We disagree that there is "no organized pattern" to the concentrations shown. In shallow overburden (Figure 4.4.5-3a), dibenzo(a,h) anthracene appears to consistently exceed the RSL east of the southern Containment Area and in the southern portion of the Olin property. It appears to be detected frequently along the eastern edge of the MMBW in deep overburden. However, we agree that these sporadic exceedances do not indicate a significant source of groundwater contamination.
33. Section 4.4.5 and Figures 4.4-6-X: Please specify in the text and figure legend if the values discussed are for total or dissolved metals.

2.5 Section 5: Fate and Transport/Conceptual Site Model

34. Section 5.1: Please add the former acid pits and the CSL to this section or provide an explanation why they were not considered to be sources.
35. Section 5.1, DAPL Pools, 1st paragraph: Please refer to a figure for the locations of the DAPL pools.
36. Section 5.1, DAPL Pools, page 5-8, 1st paragraph: The discussion of bedrock competence in this paragraph should refer to back to a complete discussion in Section 3.
37. Section 5.1, DAPL Pools, page 5-8, 3rd paragraph: Please refer to a document which outlines the DAPL chemistry in detail, preferably a primary document.
38. Section 5.2: Please provide references for discussions of chemical interactions and degradation for each contaminant and refer to Appendix F when appropriate.
39. Section 5.2.8: Please note that chloride concentrations are generally higher within the NDMA plume and in deeper overburden than in shallow overburden. Road salt may contribute some chloride, but this contribution appears to be smaller than the chloride from Site contamination.
40. Section 5.2.9: Please add references to other reports that include attribution of VOCs to other sources, or references to earlier parts of the document where discussion of these sources are introduced.
41. Section 5.3.3: Please describe impacts of the smear zone and soil sources on TMP concentrations in groundwater. The OU1/OU2 FS refers to a discussion of the smear zone and TMPs that does not exist in this report.

2.6 Section 6 Baseline Human Health Risk Assessment Summary

See Nobis comments on the Revised Draft BHHRA submitted on December 18, 2018.

2.7 Section 7: Conclusions and Recommendations

42. Section 7.1, 2nd bullet: We do not agree that the groundwater contamination outside of the Cook/Border Ave areas does not have the potential to impact future wells. Industrial and private wells are scattered throughout the area, and there are no statutory limitations on installing new wells either for drinking or for industrial use.

2.8 Section 8: References

43. Please add the following references from the report, or correct the report text if they are in error:
    a. GEI, 1998.

b. MACTEC, 2004.
c. MACTEC, 2006d.
d. DAPL Extraction pilot test (November 7, 2014).
e. Supplemental DAPL extraction memorandum (February 5, 2015).
f. Most recent SASR.

2.9 Tables

44. Table 2.2-1: Based on our database, specific gravity data is available for MP-X locations. These are not included in the "inorganics" list in this table. Please add a column for specific gravity.
45. Table 2.2-3: This table summarizes revised bedrock elevations at the Main Street DAPL pool based on Geoprobe (direct push) drilling, using two adjacent boreholes at each location. The table appears to summarize the revised elevation based on average depth; however, these depths vary by up to 4 feet. It is likely that some borings encountered shallow refusal on boulders given the presence of boulders on a Site scale and the limitations of direct-push drilling. The inferred bedrock depths should not be averaged. Olin should use the lower (deeper) value.
46. Table 4.3-1: the screening value for chromium is listed as 100 µg/L and the range of detections is up to 200,000 µg/L in Aberjona and 7,000 in Ipswich watershed overburden wells; however, the number of detections exceeding the screening value is 0. Please check.

2.10 Figures

47. Figure 2.2-2 is called "OU3 Groundwater Sample Locations"; however, it shows several wells that are not included in Table 2.2-1 (e.g. LPB-X wells, E-10, W-10, PZ-X locations, GW-12, etc.). Section 2.2.2, 2nd paragraph states that it also depicts shallow and deep overburden and bedrock monitoring wells, suggesting that Figure 2.2-2 shows all available monitoring wells and not just the ones sampled. Please change the symbols, colors, or otherwise distinguish the wells that were sampled from wells that were not sampled in the OU3 investigations.
48. Figure 2.2-3 should also include additional items:
    a. The piping runs for the extraction system.
    b. Bedrock contour lines.
    c. Initial (pre-test) DAPL extent.
    d. Current DAPL extent.
49. Figure 2.2-4: Please indicate which wells were used for each of the phases of HPIT (suggest as separate colors).

50. Figure 3.1-1: Please ensure that topographic contours are complete for the entire area, particularly northwest of Main Street and north of Eames Street. We recommend using available LIDAR data for full site-wide coverage.
51. Figure 3.2-3, 3.2-4 and 3.2-5 have a vertical exaggeration of 1:17 and do not depict a vertical scale. Please present a vertical scale that is directly comparable to a horizontal scale (such as using 1:10 vertical exaggeration).
52. Figure 3.2-7 depicts interpreted fracture traces and only includes fracture traces in the MBW based on the Smith, 1997 seismic data. Please revisit the seismic data collected after 1997 to identify additional fracture traces (if any).
53. Figure 3.2-1 in the FRI (MACTEC, 2007) depicts additional fault contacts not shown on Figure 3.2-7. Please re-evaluate these fracture traces and add them to Figure 3.2-7, if relevant. If Olin considers these irrelevant, please explain why this data was not used.
54. Figures 4.4.2-2a through c, 4.4.2-3a through c, 4.4.2-4a through c, and all Section 4 plan view figures after 4.4.2-5b are missing the NDMA impact contour. Please add.
55. Figure 4.4.2-3b should have isoconcentration contours around nitrate concentrations above the MCL near the DAPL pools.
56. Figure 4.4.5-2b appears to have contiguous areas of diphenyl ether concentrations in the following locations: between GW-408D and MP-2, the area between MP-3; GW-45D, and GW-69D; and the area extending northeast from GW-55D to GW-17D, including MP-1. The available data suggest a much larger area of diphenyl ether exceedances of the RSL.
57. Figure 4.4.5-3a through c: Please add the figure numbers to the title block.
58. Figure 4.4.6-x: Please renumber either the figures or the text for the metals after aluminum so that they are in the same order.
59. Figure 5.1-1 should also include all port/monitoring well screen depths for the locations on the cross-sections, not just those associated with DAPL or diffuse groundwater.

2.11 Appendices

60. Appendix A-2; DAPL pilot test data: please add headers or another indication of which parameter is associated with each of the tables.
61. Appendix E: Please add field parameters (can be separate tables) to this or to a separate appendix, especially specific conductivity, since it is a critical parameter frequently used to define whether a sample is representative of DAPL or diffuse groundwater and has only rarely been included on the list of laboratory analyses.
62. Appendix F: Olin used the maximum metals value available for instances where both total and dissolved metals results were available for a single sample. However, it would be

helpful to evaluate outliers (in terms of potential sample turbidity) that can skew metals concentrations.

63. Appendix J: See OU1/OU2 FS comments on Appendix A (Nobis, 2019b).

3.0 REFERENCES

Amec Foster Wheeler, 2015. Final Data Gap Analysis and Additional Field Studies Work Plan – Operable Unit 3. Olin Chemical Superfund Site, Wilmington, MA. July 3.

AMEC, 2018. Draft Remedial Investigation Report, Operable Unit 3, Olin Chemical Superfund Site, Wilmington, Massachusetts. March 30.

CRA, 1993. Comprehensive Site Assessment, Phase II Field Investigation Report, Wilmington Facility, Wilmington, MA, Olin Corporation. June.

EPA, 2019. EPA's Response to Olin's January 2, 2019 Response to EPA's Comments on Olin's Draft Remedial Investigation and Feasibility Study Reports Submitted on September 25, 2018. March 8.

MACTEC, 2007. Draft Focused Remedial Investigation Report, Olin Chemical Superfund Site, Wilmington, Massachusetts. October.

MACTEC, 2009. Final Remedial Investigation/Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Massachusetts. August 14.

Nobis, 2019a. Technical Review Memorandum – Draft Final Remedial Investigation, Operable Unit 3. May 16.

Nobis, 2019b. Olin – Review Comments Regarding Revised Draft OU1 and OU2 Feasibility Study. July 24.

Smith, 1997. Supplemental Phase II Report, Olin Corporation, Wilmington, Massachusetts. June.

Wood, 2019. Revised Remedial Investigation Report, Operable Unit 3, Olin Chemical Superfund Site, Wilmington, Massachusetts. June.